

## C L A I M S

1. A fluid device (1, 20, 40, 50, 60, 70, 90, 90', 90'') for the recovery of the kinetic energy of land vehicles, comprising an intake line (13), a delivery line (15), and a pumping unit (7, 21, 103), which is connected to the intake line (13) and to the delivery line (15), said fluid device being characterized in that it comprises at least one actuating element (5, 22, 44, 52, 62, 76, 108) set along a road course (3, 75) of a road infrastructure (3a, 71) for the transit of vehicles, functionally connected to the pumping unit (7, 21) and mobile between a position of unloading and a position of loading, in which the actuating element (5, 22, 44, 52, 62, 76, 108) is designed to be surmounted by a vehicle travelling along said road infrastructure (3a, 71).

2. The device according to Claim 1, characterized in that said actuating element (22, 76, 108) is elastically deformable and has a surface (26) of contact with said vehicles.

3. The device according to Claim 2, characterized in that said surface of contact (26) is substantially plane, and in that said actuating element (22, 76, 108) comprises end portions (27) set opposite to one another and transverse with respect to a direction of travel of said vehicles and fixed to said road or railroad course (3, 75).

4. The device according to Claim 3, characterized in that said end portions (27) are aligned to said road or railroad course (3, 75).

5. The device according to Claim 4, characterized in that said actuating element (22) is a membrane, and defines, at the top, a first variable-volume chamber (23) connected to said intake line (13) and said delivery line (15).

6. The device according to Claim 4, characterized in that it comprises a honeycomb structure (103) for pumping connected to said intake line (13) and said delivery line (15), which defines a multiplicity of second variable-volume chambers (109) delimited, at the bottom, by a supporting wall (100, 111) and co-operating, at the top, with said actuating element (22).

7. The device according to Claims 5 and 6, characterized in that said honeycomb structure (103) is set inside said first chamber (23), and in that each of said second variable-volume chambers (109) is delimited by side walls (107), which come out of said supporting wall (100) and, at the top, from a deformable head membrane (108) connected in a fluid-tight way to said side walls (107) and co-operating with said actuating element (22).

8. The device according to Claim 6, characterized in that said second variable-volume chambers (109) are delimited at the sides by a multiplicity of rigid separating walls (111), which are hinged to said actuation element (22) and to the supporting wall (110).

9. The device according to any one of the preceding claims, characterized in that said device is supported, at the bottom, by a base (101), which has a plurality of intake tanks or chambers (102) that are fluid-connected to one another by said intake line (13).

10. The device according to any one of the preceding claims, characterized in that it comprises an elastic element (24, 73), which co-operates with said actuating element (22, 76) and is designed to re-establish said unloading position.

11. The device according to any one of Claims 1 to 10, characterized in that said road infrastructure (3a) is a

street.

12. The device according to any one of the preceding claims, characterized in that said road infrastructure (71) is a railroad line, in that said road course (75) comprises tracks, and in that said actuating element (76) comprises rails.

13. The device according to any one of Claims 1 to 4, characterized in that said road infrastructure (71) is a railroad, comprising a bed (73) and a multiplicity of sleepers (74) supported by said bed (73), and in that said pumping unit (77) is functionally connected to respective said sleepers (74).

14. The device according to Claim 13, characterized in that said pumping unit (7) comprises an oscillating actuating member (62).

15. The device according to any one of the preceding claims, characterized in that it comprises a unit for generation of electric power (17, 18) connected to said delivery line (15).

16. The device according to any one of the preceding claims, characterized in that said fluid is hydraulic.

17. The device according to any one of the preceding claims, characterized in that said fluid follows a closed circuit (150).

**AMENDED CLAIMS**

[received by the International Bureau on 03 December 2004 (03.12.04);  
original claims 1-17 replaced by new claims 1-15 (4 pages)]

1. A fluid device (1; 20; 40; 50; 60; 70; 80; 90;  
5 90'; 90'') for recovery of the kinetic energy of  
vehicles, comprising an intake pipe (13), a delivery  
pipe (15), and a pumping unit (7; 22), which is  
connected to said intake pipe (13) and to said  
delivery pipe (15) for sending fluid under pressure  
10 from said intake pipe (13) to said delivery pipe  
(15), at least one actuating element (5; 22; 44; 52;  
62; 76; 108), which is set along a road or railway  
course (3; 75) of a road or railway infrastructure  
(3a; 71) for land vehicles, is connected to said  
15 pumping unit (7; 22) and can move between a position  
of unloading and a position of loading, in which said  
at least one actuating element (5; 22; 44; 52; 62;  
76; 108) is adapted to be surmounted by a vehicle  
travelling along said road or railroad course (3;  
20 75), said device being characterized in that said  
actuating element (22; 76; 108) is elastically  
deformable and has a contact surface (26) in contact  
with said vehicles and substantially aligned to said  
road or railroad course (3; 75). .
- 25 2. The device according to Claim 1, characterized in  
that said surface of contact (26) is substantially  
plane, and in that said actuating element (22; 76;  
108) comprises end portions (27) longitudinally set  
opposite to one another and rigidly connected to said  
30 road or railroad course (3; 75).
3. The device according to Claim 2, characterized in

that said actuating element (22) comprises a membrane, and defines, at the top, a first variable-volume chamber (23) connected to said intake line (13) and said delivery line (15).

5 4. The device according to Claim 3, characterized in that it comprises a honeycomb structure (103) for pumping connected to said intake line (13) and said delivery line (15), which defines a multiplicity of second variable-volume chambers (109) delimited, at  
10 the bottom, by a supporting wall (100, 110) and co-operating, at the top, with said actuating element (22).

5. The device according to Claims 3 and 4, characterized in that said honeycomb structure (103)  
15 is set inside said first chamber (23), and in that each of said second variable-volume chambers (109) is delimited by rigid side walls (107), which come out of said supporting wall (100) and, at the top, from a deformable head membrane (108) connected in a fluid-tight way to said side walls (107) and co-operating  
20 with said actuating element (22).

6. The device according to Claim 5, characterized in that said second variable-volume chambers (109) are delimited at the sides by a multiplicity of rigid  
25 separating walls (111), which are hinged to said actuation element (22) and to the supporting wall (110).

7. The device according to any one of the preceding claims, characterized in that said device is  
30 supported, at the bottom, by a base (101), which has a plurality of intake tanks or chambers (102) that

are fluid-connected to one another by said intake line (13).

8. The device according to any one of the preceding claims, characterized in that it comprises an elastic  
5 element (24; 73), which co-operates with said actuating element (22; 76) and is designed to re-establish said unloading position.

9. The device according to any one of Claims 1 to 8,  
10 characterized in that said road infrastructure (3a) is a street.

9. The device according to any one of claims 3 to 8, characterized in that said road infrastructure (71) is a railroad line comprising sleepers (74), in that said road course (75) comprises tracks, in that said  
15 actuating element (76) comprises rails and in that said membrane (22) functionally cooperates with said rails.

10. The device according to any one of Claims 1 or 2, characterized in that said road infrastructure (71)  
20 is a railroad, comprising a bed (73) and a multiplicity of sleepers (74) supported by said bed (73), in that said actuating element (76) comprises rails connected to said sleepers (74) and in that said pumping unit (7) is functionally connected to at  
25 least one of said sleepers (74).

11. The device according to Claim 10, characterized in that it comprises an oscillating actuating member (62) connected to one of said sleepers (74) and said pumping unit (7).

30 12. The device according to any one of the preceding

claims, characterized in that it comprises a unit for generation of electric power (17, 18) connected to said delivery line (15).

5 13. The device according to any one of the preceding claims, characterized in that said fluid is hydraulic.

14. The device according to any one of the preceding claims, characterized in that said fluid follows a closed circuit (150).

10 15. The device according to any one of the preceding claims, characterized in that it comprises rigid elements (105, 107a) disposed below said actuating element (5; 22; 44; 52; 62; 76; 108) and supporting said actuating element (5; 22; 44; 52; 62; 76; 108)  
15 in said loading position.

## STATEMENT UNDER ARTICLE 19(1)

5       The Examiner's remarks have been duly taken into consideration and it is believed that the invention as now claimed is both novel and inventive over the cited prior art.

      New claim 1 has been drafted as a combination of  
10 original claims 1, 2 and 4. Neither of the cited documents discloses or suggests a fluid device for recovery of kinetic energy as claimed.

      The closest prior art fluid device, considered to be the one disclosed in US4212598, comprises a  
15 resilient tube 18 housed inside a recess 14 placed transversally on a street and a rigid treadle 28 hinged on one lateral side of recesses 14 and covering tube 18 being inclined with respect to a surface 12 of the street. The known device further  
20 comprises a flap-like bearing member 24 narrower than treadle 28 and hinged to the street surface 12 on a lateral side of recess 14 opposite to mobile treadle 28.

      During operation, the known device is repeatedly



impacted by travelling vehicles and is pressed on an abutment surface that is connected with the external ambient and may collect small banks of debris causing an irregular contact and a distortion of the rigid  
5 treadle 28.

Therefore a continuous monitoring of treadle 28 is required because a permanent deformation or an unpredicted breaking of treadle 28 would compromise stability and safety of travelling vehicles.

10 The use of an elastically deformable actuating member in direct contact with the tyres of the travelling vehicles allows a proper sealing against debris, thus enhancing the reliability of the device.

Furthermore, the elastically deformable  
15 actuating member is substantially aligned with the street course, which lowers the impact loads on the device and allows an efficient operation regardless the direction of motion of the travelling vehicles.

The device as claimed can be also used in  
20 railways whose bed and rails are inherently resilient and may be used to actuate a pumping unit. In this case, a railway can be equipped with reduced costs and the reliability of the device is compatible with the safety requirements needed in a railway. In fact

there is no need for a supplementary actuating element in contact with the wheels of a travelling train, and the already existing rails and bed are used without any significant structural modification.